FINERO *The Quality Control Company*

User Manual

Isolation Resistance Tester FST-120

Generalvertretung Deutschland:

TESTEC

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ANNEX A - FST-120 ISOLATION RESISTANCE TESTER - COMMAND LIST

Dear Customer,

Thank you for purchasing Finero test and measurement equipment. Finero is obliged to provide you with the best on the market available test and measurement equipment. The 30 years of Finero experience in most demanding production applications is made available to you in this piece of equipment.

We are confident that this equipment will support your endeavors to keep up the good quality of your production.

If you have any comments about Finero products, software or services I would like to hear of them.

Yours truly,

Risto Vuolle
Chief Executive Officer

Finero Inc.
Kausala, Finland

All information is subject to changes without prior notice.

DELIVERY SCOPE LIST

Although Finero packages the equipment with utmost care you should check the package regarding any delivery damages. If the equipment is damaged you should contact your insurance company directly and inform Finero as well about the matter. Please include photos if possible.

The package should include in minimum following documents and materials:

FST-120	1pc
Mains cable	1pc
User Manual	1pc
Calibration Certificate	1pc

1 TECHNICAL INFORMATION

Type :	Isolation Resistance tester FST-120
Serial number :	See the back of device
Size :	483x148x410 (width, height, depth) Designed to 19”-eurorack, height 3U 133mm without legs
Weight :	10 kg
Operation voltage :	230VAC (±10%) 50Hz 1~phase
Operation power :	30VA
Connection :	Cable plug , equipment earth
Main fuses :	250mA slow 5x20mm glass fuses inside of power connector
Ambient temperature :	+5°C...+35°C
Ambient conditions :	Dry and clean
Output voltage :	100V…1000V direct current (DC) Voltage step 10V Setting voltage ramp up time 0…10 seconds
Measurement range :	4 ranges 0,5...10MΩ , 5…100MΩ, 50…1GΩ and 500M…10GΩ. Manual or automatic range selection. Analogue meter with logarithmic scale
Output connections :	In back panel 4mm laboratory sockets
Remote control :	Start, stop, test, fail and safety circuit 24VDC D25-female -connector in back panel
Computer connection (option):	LAN, USB(B), GPIB or RS-232 connector in the back panel
RS485 Interface	To be used for device to device communication between FST-line equipment

2 GENERAL

2.1 FST-120

The Isolation Resistance measurement equipment FST-120 intended for measuring of high resistance of device under test (D.U.T.) with an adjustable voltage 100…1000VDC. Measurement range is 0,5MΩ-10GΩ.

ANY UNAUTHORIZED OPEING OF THE EQUIPMENT WILL VOID THE WARRANTY.

2.2 FST-120 control modes

The FST-120 can be controlled either locally by means of the front panel buttons, indicators and analogue meter or in automatic test systems by a computer. Other remote control possibilities exist by using the D25 connector in the back panel.

2.3 Calibration

The FST-120 is factory tested and calibrated to meet the accuracy requirements. We recommend to calibrate FST-120 regularly once a year. The equipment may be calibrated in our factory or by other means agreed separately. In the back of the equipment is a replaceable measurement module, which can be sent to calibration.

3 SAFETY PRECAUTIONS

3.1 General

The operator should study carefully the instruction manuals and operation of the FST-120 as well as testing instructions for the product to be tested before starting any tests. As a further safety precaution the operator should be aware of emergency first aid actions. The FST-120 shall only be used strictly according to this user manual. All modifications are not allowed.

3.2 High voltage WARNING

The high voltage connectors in rear panel have a dangerous high voltage during the test.

The current supplied by the FST-120 is high enough to cause convulsion and potentially to get trapped to the parts under high voltage. The FST-120 measures the current in the circuit and shall switch the voltage off if the current exceeds the set current limit, THIS FEATURE CANNOT BE USED AS A SAFETY MEASURE!

NEVER TOUCH THE HIGH VOLTAGE CONNECTORS OR TEST LEADS IF THE FST-120 IS SWITCHED ON!

4 INSTALLATION

4.1 General

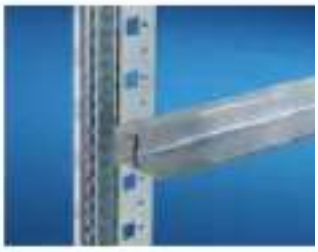
FST-120's depth is about 370mm and connectors need about 150mm space from rear. The handles mounted on the front panel are elevated about 40mm from the panel. The FST-120 is not allowed to be carried from the front panel handles. For carrying FST-120 the handles on the side of the equipment should be used.

The FST-120 can be used in its own case only in dry and clean environment. The ventilation, however, should not be prevented.

4.2 Mounting into 19" Module –Rack or Case

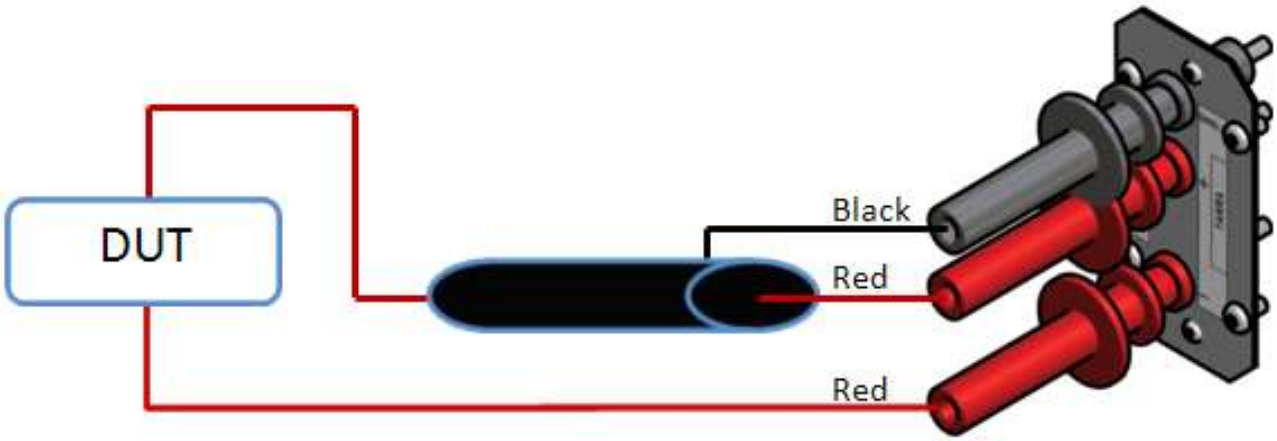
When installed into a rack or a similar case it is mandatory to use mounting rails due to the weight of the device. The holes in the front panel are intended for locking the device in its place not for backing the whole device. If there are legs below of FST-120, they must take off before installation to 19" rack. Care must be taken of the air circulation in the rack in order to avoid temperature rise above +35 °C.

Here are some examples of how build the support for rack installation.



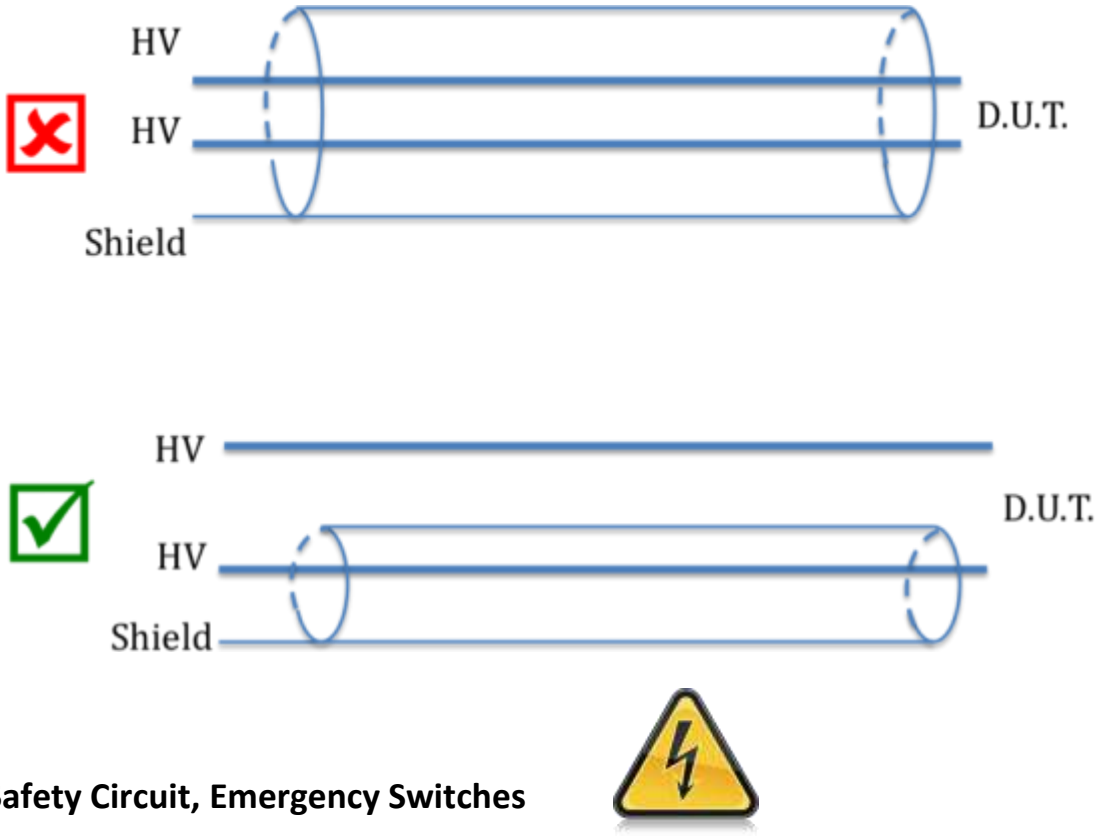
4.3 High voltage connectors

There are three high voltage sockets in back panel. High voltage outputs are two connectors in rear side. The connections are made according to the below figure.



"Shield" –connection can be used for protection against electrical noise. Connected shield (assuming that shielded cable is used) reduces measurement errors, which can be caused by cables, line noise or some other leakage currents. If you suspect measurement errors, use shielded cable and connect shield to the respective place in the unit. The shield of the LOWER connector must be connected to the SHIELD- connector at the back panel. Cables and connectors must be specified to high voltage use. Please check with the manufacturer!

See the below picture for connection recommendations.



4.4 External Safety Circuit, Emergency Switches

The FST-120 provides an external safety circuit; which prevents connection of the test voltage, when external safety circuits are open. The safety circuit connector is a part of the external D25 connector. The wiring diagram is shown in FST-120 wiring diagram. When the safety circuit is open the "Fail" –indicator is flashing, if trying start testing. See back panel figure.

The FST-120 internal safety circuit is not an approved safety relay system! The safety circuit of FST-120 is designed for indication that for instance doors and test covers are closed or respectively open. The safety device shall have potential free contact "open" when activated. The safety circuit can be wired by signal cable; the voltage is about 25 V. To take the safety circuit in use a jumper J1 (Safety) has to be removed. Location of the jumper J1 are in connection board inside FST-120 near back edge. The jumper is removed by lifting and can be stored by pressing it to one of the pins. Cables to external control lines are recommend to be kept short or use relays near FST-120.

4.5 Mains supply and Switching On the FST-120

Connect the FST-120 to the mains supply in following order:

- Check that the position of the front panel POWER switch is 0.
- Connect the control and high voltage cables to the FST-120.
- Plug the mains cord to the FST-120.
- Plug the mains cord to a mains outlet
- Switch ON the FST-120

5 MANUAL OPERATION

5.1 General

The manual operation means the use of the FST-120 by the front panel buttons, indicators and display panel. At the end of the manual there is a list of malfunctions with possible causes. Caution, there are high voltage in connectors behind FST-120 while test is ON.

5.2 Buttons and indicators

There are indicators "Test", which blinking when test is switched ON and "Fail" indicator for limit values exceeds. Test voltage switched ON with "Start" –button and switched OFF with "Stop" –button. Also there are selector wheel and "Enter" –button for control menu uses.

Button	**Used for…**
SELECT fly wheel knob	Turn to browse between parameters or select parameter value
ENTER button	Used to confirm
TEST indication	Indicates the TEST is running
Button	**Used for…**
START button	Start the test sequence
STOP button	Stop the test
FAIL indication	Indicates failed test (not passed) and loud buzzer noise will go off simultaneously

5.3 Start-Up

Power is switched on by the "Power" –switch (see 4.5). After switching the unit on calibration information is shown for a few seconds in the panel display.

→ FST-120 set values -- Ready-display

5.4 Setting Parameters

The unit has a set value memory, last time saved values are stored in flash memory (no power needed).

Setting paremeter with FST-line equipment is very easy.

After the READY display, like above please follow the instructions as below.

Setting Parameters with FST

Action	**Result**	**Display**
press ENTER for a few seconds in READY display mode	Parameter setting display	
Turn Flywheel knob to the desired parameter position and press ENTER	Ready to set parameter	
Turn flywheel knob in order to set the desired parameter value	Parameter value selected	
Press ENTER	Set parameter value confirmed	
Move cursor with flywheel knob to the EXIT and press ENTER	Exiting from parameter setting mode	

5.5 Preparation for Service Call

To check program version (for service only): press “Enter” –button when calibration information is shown.

All software version and printed circuit board versions can be seen on the display. This is important information before you contact Finero Service.

5.6 Control menu and commands

During the measurement the measured values as well as after test the last measured values are shown on front panel display.

Menu commands

Parameter	Function and setting range
U-set	Test voltage set (100V…1000V)
R-min	Resistance low limit value (0,5MΩ… high limit value)
R-max	Resistance high limit value (low limit value…9900MΩ or NU)
R-rang	Resistance range (10MΩ, 100MΩ, 1000MΩ, 10000MΩ or AUTO)
Integr	Integration time(2…250)
Ramp L	Voltage up ramp time (OFF or 0,1…10,0 seconds)
Timer	Test timer clock (OFF or 0,3s…60s)
Save	Setting value stored to memory (Yes or No)
Remote	Manual or Computer operation (Yes or No) (only in computer oper.)
EXIT	Back to “Ready-display” or Parameter setting mode

5.6.1 Resistance ranges (R-rang)

Selectable ranges are : 0,5-10MΩ, 5-100MΩ, 50-1000MΩ and 500-10000MΩ (0,5-10GΩ).

Setting “AUTO” selects the range automatically.

Under certain circumstances AUTO ranging can be slightly more accurate, however it is in any case slower than a fixed range.

5.6.2 Integration time (Integr)

Tester takes measurements and calculates resistance values. Integration time means measurement time, during A/D-converter takes samples. Units are NPLC, it means "number of power line cycles", and as an example setting of 100 equates to 2 seconds. A higher integration time value results in a better measurement accuracy, but at same test times sampling time gets longer. Test time starts when voltage is at the set value.

5.6.3 Ramp up time (Ramp L)

Test voltage ramp up time. Voltage goes from 0 to set value with the user preset ramp up time.

5.6.4 Use of timer (Timer)

FST-120 has a programmable timer for semiautomatic testing. Timer stops testing automatically when preset time is elapsed. It is still possible to interrupt the test by pressing "stop"-button. This will however result in a "fail"-alarm and "interrupted" text in display. In Timer off –mode test is ON when pressed "Stop"-button (however never exceeding 120s).

5.7 Testing

The test voltage is switched on by pressing the "Start" -button. The minimum measurement time is recommended at least 1 second.

Test voltage switched off by pressing "Stop" –button (if timer used, then according to timer setting)

After that the measurement can start again with the "Start"-button or return to "Ready" –display by pressing "Stop" –button.

6 ERROR MESSAGES

FST-120 makes alarms if measurements values are not inside set limits.

Errors:

HIGH RES	Resistance value higher than limit value (R-max).
LOW RES	Resistance value lower than limit value (R-min).
INTERRUPTED	Test is stopped by user.
LOW VOLTAGE	Voltage has not reached the set value. Maybe there are measurement errors, check Integr-value.
SAFETY CIRCUIT OPEN	FST-120 safety circuit is open.

7 OPERATION WITH COMPUTER

7.1 General

The FST-120 can be incorporated in an automatic test system providing automatic control and recording of the test results and other applications. Almost all operations are controlled by the computer or easier by using a Finero's specific proprietary application program Safetest. The command list for computer operation mode is appendix of this manual. The control interface, like USB, GPIB, RS232 or Ethernet, is optional and it must be ordered separately factory installed. All FST-line equipments are delivered standard with RS485 interface. By using this interface all FST-line equipments can communicate with each other.

7.2 Connections

The RS485 connection to other FST-120 must be done by a shielded Cat5 cable (STP) RJ45 (8 pin connector).

Other computer interfaces like USB, GPIB, RS232 and Ethernet, are connected with commercially available and compatible cables. The cables are not part of the delivery scope.

8 REMOTE CONTROL AND LOGIC OPERATION

8.1 General

This means a possibility to incorporate the FST-120 in less sophisticated automatic test systems. The FST-120 operates as in the manual mode but has a provision for extra output contacts for indicators and logic inputs for the control buttons.

8.2 Start-up

Basically the FST-120 will be put into operation as in manual mode. In addition the wiring of the operator connector at the rear is to be done. The connector is a 25-pin D-type female connector. In the main circuit diagram connections of the D25 connector are explained. Maximum output from +25V are 300mA (7,5W).

8.3 Logic Connections

Contacts are available to show state of test and test result. Also there are two extra outputs, which are possible programmed.

“Test On” output are on, when voltage is on.

“Fail” output are on, when test current is higher than limit value. At the same time the test is interrupted.

The connector has logic inputs like the start and stop buttons. Also there are two extra inputs, which are possible programmed.

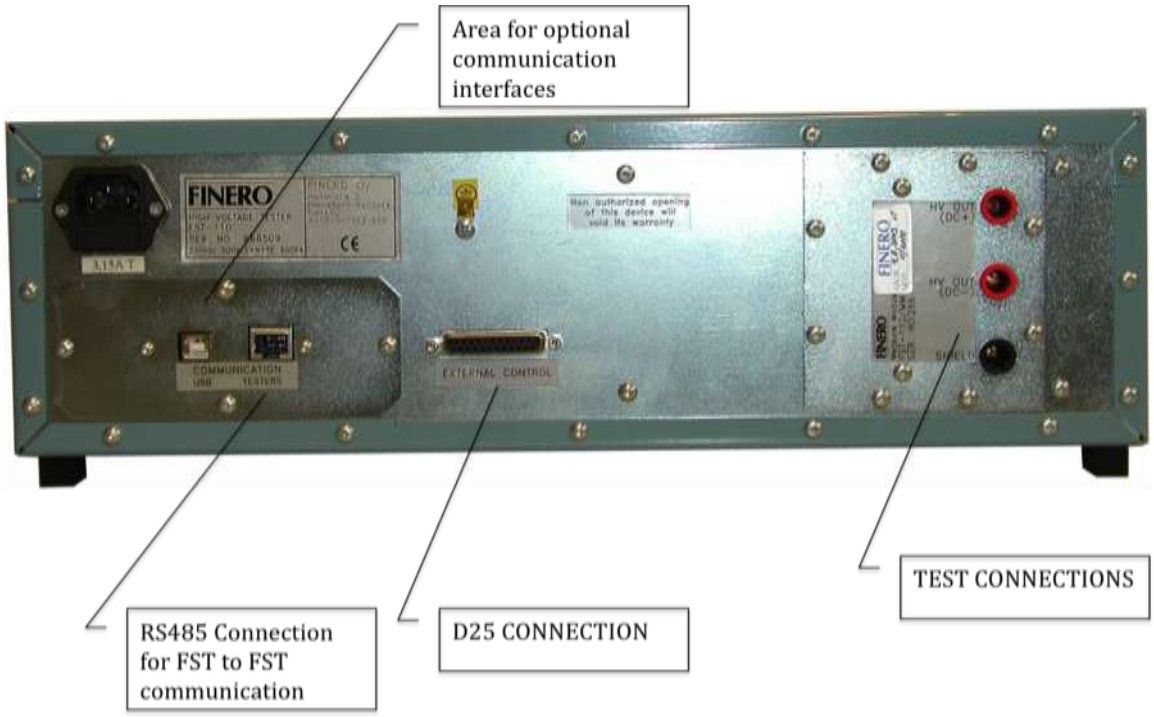
“Start” signal switches the test voltage on.

“Stop” signal disconnects the test voltage.

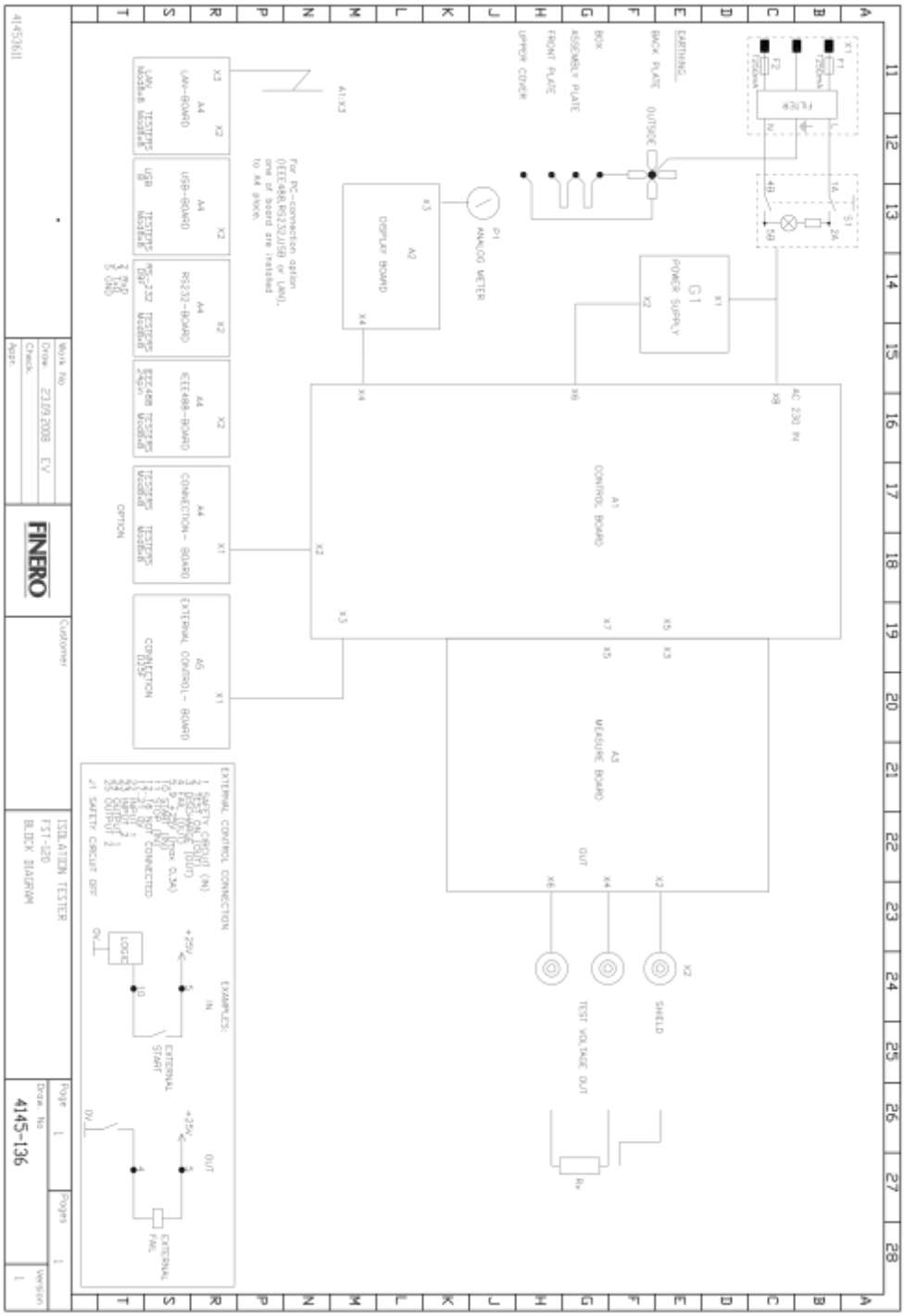
The connector has inputs for the safety circuit, if circuit is open high voltage are not connected.

9. BACK PANEL OF AN FST-LINE EQUIPMENT

The below picture shows a typical back panel of an FST-line product.


Area for optional communication interfaces
TEST CONNECTIONS
RS485 Connection for FST to FST communication
D25 CONNECTION

10. MAIN CIRCUIT DIAGRAM



11 FAULT FINDING

No indicator is lit	• Check the power cord connectors are properly plugged at both ends • Check the voltage in the mains socket. • Check the main fuses (F1 and F2) of the FST-120. The fuses are located in the fuse box below the power cord connector. Check the fuse by a multimeter for conductivity and replace with the similar one if necessary.
Indicators are lit but buttons don't function	• Check the safety circuit • Check set values in "Setting" menu.
FST-120 functions but high voltage is missing or voltage output is wrong	• Possibly the temperature switch inside the unit transformer has caused the equipment to stop • Wait for a moment and try again • If the occurs several times please contact Finero Service

If the above remedies do not remove the problem, please contact the Finero Service or Finero authorized service point.

Finero Service

For Service and Support please contact one of our representantives or

Tel. +358 5 752 2200
e-mail: fineroservice@qacontrol.com

12 LIMITED WARRANTY

All of our products and test systems are covered by a standard 12-month warranty period. The warranty period starts on the original shipment date of the product or test system. Our product and test system warranties guarantee that our products will be free from defects in material and workmanship and we will repair or replace any such Finero product or test system we find to be defective.

All new Finero products and test systems are calibrated prior to shipment. Finero products and test systems require annual calibration, if Finero has not given any other written instruction, and Finero accepts only calibrations made by an approved Finero partner or by Finero factory.

If your product during the 12-month warranty period fails to perform as Finero has specified please return the product to the below address or to one of our approved partners.

Warranty work includes parts and labour at Finero's cost, but excludes shipping costs. Finero products returned for warranty repair and found to be in proper working order may be subject to a shipping and handling fee.

Any non-authorized modification, repair, tampering or physical damage or if the product has been subject to gross misuse will void this warranty. Elimination of any connections in the earth grounding system or bypassing any safety systems will void this warranty. Parts subject to wear, such as test probes and leads, are not covered by this product warranty, except where they are deemed to have a manufacturing defect within 60 days of the original shipment of the Finero product.

Except as provided herein, Finero makes no warranties to the purchaser of Finero products and test systems and all other warranties, expressed or implied (including, without limitation, merchantability or fitness for a particular purpose) are hereby excluded, disclaimed and waived.

FINERO SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT CONSEQUENTIAL, INCIDENTAL OR OTHER SIMILAR DAMAGES SUFFERED BY THE PURCHASER OR ANY THIRD PARTY, INCLUDING WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS OR BUSINESS OR DAMAGES RESULTING FROM USE OR PERFORMANCE OF THE PRODUCT OR TEST SYSTEM, WHETHER IN CONTRACT OR IN TORT, EVEN IF FINERO OR ITS AUTHORIZED REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND FINERO SHALL NOT BE LIABLE FOR ANY EXPENSES, CLAIMS, OR SUITS ARISING OUT OF OR RELATING TO ANY OF THE FOREGOING.

Due to continuous development of the products warranty does not include updating of features

When the warranty repair is booked the customer is requested to inform type and serial number of the equipment and description of the malfunction as detailed as possible. The repair shall be carried out in reasonable time during normal working hours. If immediate repair is demanded or done outside of normal working hours the extra costs may be born to the customer account. The warranty repair is done primarily at the manufactures premises.

Return address: Finero Oy, Service and Calibration, Haltonintie 5, FIN-47400 Kausala, FINLAND

ANNEX A

FST-120 ISOLATION RESISTANCE TESTER

COMMAND LIST

NOTICE!

IF YOU HAVE ORDERED A COMPUTER INTERFACE WITH YOUR FST-EQUIPMENT THIS ANNEX IS RELEVANT FOR THE PROGRAMMING

Finero Oy – The Quality Control Company
Haltonintie 5, FIN-47400 KAUSALA, FINLAND
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Tel. +358-5-7522 200
Fax +358-5-3638 326
sales@qacontrol.com

Summary of Tester Commands

RS-parameter : Communication rate 19200, 8 data bits, 1 stop bit, no parity

ISO	Commands are use to FST-120 isolation tester
VOLTage 500	Voltage set value 100…1000V
RESistance:RANGe 1	Resistance range 1...5(=10/100/1000/10000/Auto MΩ)
RESistance:MAXimum 900	Resistance high limit 0,5…10000 (10000=Not Use)
RESistance:MINimum 500	Resistance low limit 0,5…10000
NPLC 100	Integration time in number of power line cycles 2…250 (100=2sec)
TIMer 10	Timer 1/10 seconds 0…600 (0=off, 600=60seconds)
RLENght 10	Test voltage up ramp time 1/10 seconds 0…100 (0=off, 20=2seconds)
ON	Test voltage on
OFF	Test voltage off
ALARm:ON	Tester alarm (software)
ALARm:OFF	Tester alarm off (software)
OUT1:ON	External control OUT1 ON or OFF
OUT2:OFF	External control OUT2 ON or OFF
IDN""	Tester identify code, maximum 20 characters
RES?	Results: Resistance, voltage, status and test time
VOLT?	Measurement voltage value
STAT?	Tester status
TIM?	Test time and all test time
OUT?	External controls output status
IN?	External control input status
CAL?	Tester calibration date
VER?	Tester version
IDN?	Tester identify code

Tester commands, specification and examples:

ISO
(iso))

All next commands are use to FST-120 tester (isolation tester

Example:

ISO;VOLT 500Command to isolation tester and test voltage are 500V

VOLTage m
m= test voltage

Setting test voltage (100V…1000V)

Examples:

VOLT 500	Test voltage 500V
VOLT 1000	Test voltage 1000V

RESistance:RANGe m
m= measuring range

Setting resistance range 1…5(=10/100/1000/10000/AutoMΩ)

Examples:

RES:RANG 1	Resistance range (0,5MΩ…10MΩ)
RES:RANG 2	Resistance range (5MΩ…100MΩ)
RES:RANG 5	Automatic resistance range (0,5MΩ…10GΩ)

RESistance:MAXimum m
m=resistance high limit

Setting resistance high limit value (0,5-10000). 10000 = Not Use. After point (or dot) not more than 1 number. If measurement value exceed high limit, test goes off, tester makes alarm and status 1 bit 1 and status 2 bit 1 settings up.

Examples:

RES:RANG 1;RES:MAX 1	Resistance high limit 1MΩ
RES:RANG 2;RES:MAX 1000	Resistance high limit 1000MΩ

RESistance:MINimum m Setting resistance low limit value (0,5-10000). After point (or dot)
m=resistance low limit not more than 1 number. If measurement value are under low limit test goes off, tester makes alarm and status 1 bit 1 and status 2 bit 0 setting up.

Examples:

RES:RANG 1;RES:MIN 0.5 Resistance low limit 0,5MΩ
RES:RANG 2;RES:MIN 10 Resistance low limit 10MΩ

NPLC m Integration time is time, when tester A/D-converter makes measuring and calculation. Higher value meaning higher accuracy and longer test time. Time value are "number of power line
m=integration time
cycles", so value 100 meaning 2 seconds.

Example:

NPLC 100 Integration time 100 (=2 sec)

TIMer m Test time in 1/10 seconds (1…600 or 0=off). Test are automatically off (and status 1 bit o setting up), when setting time are go end. Test time starts, when voltage are in setting value.

Example: TIM 20 Test time 2 seconds

RLENght mmm Test voltage up ramp time in 1/10 seconds (1…100 or 0=off)

Example:

RLEN 15 Ramp up time 1,5 seconds

ON Test voltage on. (same like Start-button). Remove same time ALAR:ON command effect. Reset some status bits (see STAT?).

Example:

ISO;VOLT 500 Commands to Isolation tester,

RES;RANG 1;RES:MIN 0.6	test voltage 500V, range 10MΩ,
ON	resistance limit 0,6MΩ, teststart

OFF

Test voltage off. (same like Stop-button). If test voltage are on before command, then voltage goes off (test ok –display). If test are off before command, tester display setting values (ready –display). Reset some status bits.

Example:

ISO;VOLT 500	Commands to Isolation tester,
RES;RANG 1;RES:MIN 1	test voltage 500V, range 10MΩ,
ON	resistance limit 1MΩ, test start
….	Test time loop
OFF	test stop

ALARm:ON

Stops testing and set Fail indicator on and buzzer ringing about 1 seconds. Used for software fail- alarm.

Example: ALAR:ON

Alarm: OFF

Tester Fail indicator off

Example: ALAR:OFF

OUT1:ON

External control output 1 on

OUT2:ON

External control output 2 on

OUT1:OFF

External control output 1 off

OUT2:OFF

External control output 2 off

IDN ” ”

Tester identify code (free setting), maximum 20 characters (not ”-marks). Normal there are tester type and serial number.

Example: IDN "FST-120 sno 557501"

RES? Give test results: resistance, voltage, status byte 1, test time. Return answer four numbers : aa bb cc dd

aa	Resistance (0.5…10200), 0.4=range low limit, 10201=range high limit, -1 can not measure
bb	Test voltage (0-1009), -1= can not measure
cc	Status byte 1 (STAT?)
dd	Test time from measurement starting (0..600=0..60s)

VOLT? Test voltage, return answer in real voltage in test. (0…1009V, 9999=can not measure (=integration time))

Example:

```
ISO;VOLT 500
RES:RANG 2;RES:MIN 1
ON
VOLT?        Test voltage
```

STAT? Tester status. Return answer two status bytes mmm nnn. Reset some bits.

mmm Status byte 1

Bit	Value	Meaning	Resetting
0	1	Test OK	ON/OFF
1	2	Test FAIL	ON/OFF
2	4	Tester are in local-operation	
3	8	Safety circuit open	
4	16	Communication error	STAT?
5	32	Tester function error	STAT?
6	64		
7	128		

nnn Status byte 2

Bit	Value	Meaning	Resetting
0	1	Low limit fail	ON/OFF
1	2	High limit fail	ON/OFF
2	4	Low test voltage	ON/OFF
3	8		
4	16	Communication error MM-IT	STAT?
5	32	Communication error RS-IT	STAT?
6	64	Communication error DNN-IT	STAT?
7	128	Communication error PC-RS	STAT?

Example:

ISO;VOLT 500;RES:RANG 2:MIN 1;TIM 10 Settings
ON Test start
STAT? Asking status. If end of test status byte 1 value are 1 test are ok, but if value are 2, test are fail. Status byte 2 send reason of failing.
RES? Asking resistance value

TIM? Testing time in 1/10 seconds. Return answer two numbers : aa bb

aa test time from measurement starting (0..1200=0..120s)
bb setting test time 1/10 seconds (0..600, 0=timer off)

OUT? External control outputs status. Return answer two numbers : aa bb

aa Output 1 status (0=off, 1=on)
bb Output 2 status (0=off, 1=on)

IN? External control inputs status. Return answer two numbers : aa bb

aa Input 1 status (0=off, 1=on)
bb Input 2 status (0=off, 1=on)

CAL? Tester calibration date. Return answer dd.mm.yyyy (=29.08.2001)

VER? Tester inside circuits (pcb) and software versions.

Example:

RS-4122v1/v1.1 MM-4121v0/v1.0 IT-4117v0/v1.0 DNN-4074v3/v1.0

IDN? Tester identify code. Return answer from tester free setting code.

Example: FST-120 sno: 557501